Applicability of linear driving force (ldf) mass transfer model for heavy metal biosorption in packed bed column

ABSTRACT

Adsorption technique for industrial effluent treatment as well as recovery of valuable components have been widely accepted for application. Since then, many researches on adsorption field have been established to investigate the economical yet having high separation efficiency of adsorbent for specific purpose. Biosorbent, for instance have shifted the focused of researches due to their abundant existence that can be easily converted into adsorbent, and some showed promising separation properties. However, the study on the biosorbent adsorption usually limited until the isotherm determination in batch experimental study. The dynamic behaviour of the system requires the experimental set-up in packed bed column, which is primarily controlled by the mass transfer mechanism. Mathematical expression describing the system is very useful as preliminary estimation of the system dynamic behaviour, provided by several input parameters such as isotherm parameters and mass transfer coefficients. Linear driving force (LDF) model approximation has proved its reliability to describe the dynamic behaviour of a system over a wide range of adsorption process. By taking three (3) experiments adsorption system on packed bed, the respective systems were simulated employing LDF approximation to obtain the dynamic behaviour of the system. The breakthrough curves were simulated by using the simplified mathematical model of LDF approximation. It is shown that the predicted LDF approximation give acceptable agreement to the experimental data with error of less than 15%, provided with mass transfer coefficient predicted from correlation. Overall, this work proved that it is possible to accurately determine the behaviour of the system using LDF approximation accompanied with the predicted mass transfer coefficient (MTC) from correlation and accurately determined adsorption isotherm for continuous system. Therefore, the mass transfer approximation is further used for evaluation of industrial-scaled packed bed column.